1. Define electronics.
Electronics is that branch of applied physics which deals with the control of motion of electrons using different devices for various useful purposes.

****2. What is meant by thermionic emission? Name two factors which enhance thermionic emission.**
The process of emission of electrons from the hot metal surfaces is called thermionic emission.

(i) Heating a metal at high temperature
(ii) Electrically heating a fine tungsten filament.

3. Define Cathode Rays.
The beam of electrons was called a cathode ray, because the electron had not yet been discovered.

***4. Give two reasons that support fact cathode rays are negatively charged.**

(i) They deflect towards positive terminal when passes through electric field.
(ii) Cathode rays have reducing effect and cause chemical change, which shows they are negatively charged.

***5. What is meant by cathode-ray oscilloscope (C.R.O)?**
The cathode-ray oscilloscope is an instrument which is used to display the magnitudes of changing electric currents or potentials in form of graph.

The information is displayed on the screen of a "cathode-ray tube". This screen appears as a circular or rectangular window usually with a centimeter graph superimposed on it.

***6. Write the names of the components of the CRO.**
The cathode-ray oscilloscope (C.R.O) consists of the following components:

(i) The electron gun with control grid
(ii) The deflecting plates
(iii) A fluorescent screen

7. What is the role of electron gun in CRO? Also describe its function.
In the CRO, the electron gun is used to generate a beam of high-speed electrons.

Function of Electron Gun: The electron gun consists of an electron source which is an electrically heated cathode that ejects electrons. Electron gun also has an electrode called grid G for controlling the flow of electrons in the beam. The grid is connected to a negative potential. The more negative this potential, the more electrons will be repelled from the grid and hence fewer electrons will reach the anode and the screen. The number of electrons reaching the screen determines the brightness of the screen. Hence, the negative potential of the grid can be used as a brightness control. The anode is connected to positive potential and hence is used to accelerate the electrons. The electrons are focused into a fine beam as they pass through the anode.

8. Describe the role of deflecting plates in CRO.
After leaving the electron gun, the electron beam passes between a pair of horizontal plates. A potential difference applied between these plates deflects the beam in a vertical plane. This pair of plates provides the $Y\text{-}axis$ or vertical movement of the spot on the screen. A pair of vertical plates provides the $X\text{-}axis$ or horizontal movement of the spot on the screen.

9. What is meant by Fluorescent Screen?
The screen of a cathode-ray tube consists of a thin layer of phosphor, which is a material that gives light as a result of bombardment by fast moving electrons.

****10. Consider an oscilloscope explain (i) how filament is heated? (ii) Why filament is heated?**
(i) In electron gun the filament is heated by 6V supply
(ii) The filament is heated to eject electrons by thermionic emission.

***11. Write some uses of oscilloscope.**
The CRO is used in many fields of science, some uses are given below:

(i) Displaying waveforms
(ii) Measuring voltages
(iii) Range-finding (as in radar)
(iv) Echo-sounding (to find the depth of seabeds)
(v) To display heartbeats.

****12. What do you understand by digital and analogue quantities?** *(ALP)*

Analog Quantities	Digital Quantities
The quantities whose values vary continuously or remain constant are known as analogue quantities.	The quantities whose values vary in non-continuous manner are called digital quantities.
For example, the temperature of air varies in a continuous fashion during 24 hours of a day.	For example, suppose you just take a temperature reading every hour.

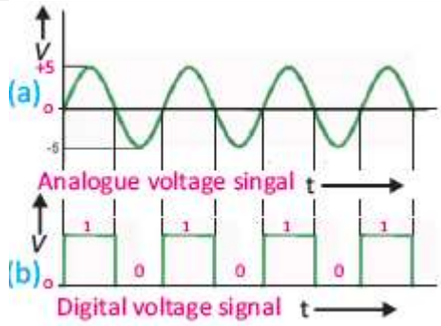
****13. Differentiate between analog and digital electronics.** *(ALP)*

Analog Electronics	Digital Electronics
The branch of electronics which processes the data being provided in the form of analogue quantities is called analogue electronics.	The branch of electronics which processes the data being provided in the form of digits is known as digital electronics.
Examples	Examples

Radio, Television, Telephone, Washing machine	Computer, Digital camera, Mobile phone, Calculator

****14. Differentiate between analogue signal and digital signals.** *(ALP)*

Analog Signals	Digital Signals
A continuously varying signal is called an analogue signal.	A signal that can have only two discrete values is called a digital signal.
For example, an alternating voltage varying between the maximum value of +5V and the minimum value of -5V is an analogue signal as shown in figure a.	For example, a voltage with square waveform is a digital signal. This signal has only two values i.e., +5 V and 0 V as shown in figure b. The High voltage is +5 V and the low voltage is 0 V.



****15. Define digital electronics.** *(ALP)*

The branch of electronics which deals with digital quantities is called digital electronics.

Digital electronics uses only two digits '0' (zero) and '1' (one) and the whole data is provided in binary form due to which processing of data becomes easy.

16. Write uses of digital electronics. *(ALP)*

For quite a long period, the use of digital electronics was limited to computers only. But, now-a-days its application is very wide spread. Modern telephone system, radar system, naval and other systems of military importance, devices to control the operation of industrial machines, medical equipments and many household appliances are using digital technology.

****17. What is meant by analogue to digital converter (ADC) and digital to analogue converter (DAC)** *(ALP)*

ADC: A special circuit has been designed which converts the analogue signal into a digital one in the form of digits. This circuit is known as analogue to digital converter ADC.

DAC: A circuit that is designed to convert digital output into analogue form by a circuit known as digital to analogue converter (DAC).

***18. What is meant by binary variables?** *(ALP)*

Such things which can have only two possible states are known as binary variables. The states of binary variables are usually represented by the digits '0' and '1'.

***19. What is meant by Boolean algebra (algebra of logics)? How it is represented?** *(ALP)*

It is a branch of mathematics which deals with the relationships of logic variables. Instead of variables that represent numerical quantities as in conventional algebra, Boolean algebra handles variables that represent two types of logic propositions; $true$ and $false$.

***20. What is meant by logic states (logic variables) and logic gate.** *(ALP)*

Logic State: Boolean algebra operates with two logic states 1 and 0. When the switch is closed current passes through the circuit and lamp is ON, we can say the value of the output is '1' and it is '0' when no current is passing. These two states are called logic states or logic variables.

Logic Gate: Logic gates are the circuits which implement the various logic operations. These are digital circuits which have one or more inputs but only one output. or A logic gate is a switching circuit i.e. a digital circuit.

***21. Define truth table.** *(ALP)*

The truth tables are tables which give the values of the inputs and outputs of the basic types of logic gates or combination of such gates. **OR** Set of inputs and outputs in binary form is called truth table.

***22. What are the three universal Logic Gates?** *(ALP)*

There are three universal logic gates:
(i) AND Gate **(ii)** OR Gate **(iii)** NOT Gate

****23. What is meant by AND operation? Also write its symbol and truth table.** *(ALP)*

The circuit which implement the AND operation is known as AND gate.

AND operation is represented by switches (two or more) connected in a series, with each switch is representing an input and only one output.

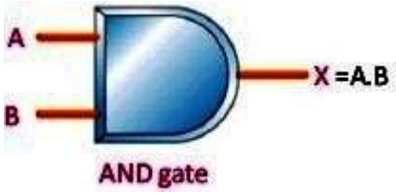
It operates in such a fashion that the value of its output is only 1 when all of its inputs are at 1. For all other values of inputs, the output would be zero.

Symbol:

Symbol for AND operation is dot $(\cdot)$. Its Boolean expression is:

$$X = A.B$$

and is read as "X equals A AND B".



Truth table:

A	B	$X = A.B$
0	0	0
0	1	0
1	0	0
1	1	1

****24. What is meant by OR operation? Also write its symbol and truth table.** ***(ALP)***

The circuit which implement the OR operation is known as OR gate.

OR operation is represented by switches (two or more) connected in a parallel, with each switch is representing an input and only one output.

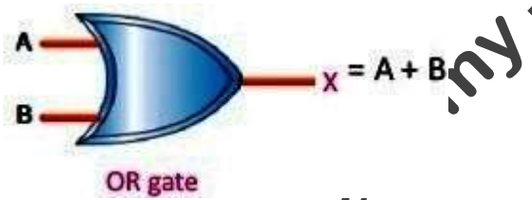
It operates in such a fashion that its output is 1 even one of its input is 1. The value of its output will be zero when all of its inputs are zero.

Symbol:

Symbol for OR operation is plus $(+)$. Its Boolean expression is:

$$X = A + B$$

and is read as "X equals A OR B".



Truth table:

A	B	$X = A + B$
0	0	0
0	1	1
1	0	1
1	1	1

****25. What is meant by NOT operation? Also write its symbol and truth table.** ***(ALP)***

The circuit which implement the NOT operation is known as NOT gate.

NOT operation is represented by one switch is representing an input only one output.

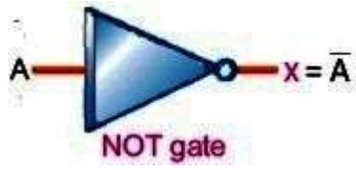
It operates in such a fashion that if its input is 0, its output will be 1. Similarly, if the input is 1, then its output will be 0.

Symbol:

NOT operation is represented by a line or bar over the symbol i.e.,

$$X = \bar{A}$$

and is read as "X equals A NOT".



Truth table:

A	$X = \bar{A}$
0	1
1	0

26. Define NAND gate. Also write its symbol and truth table.** ***(ALP)

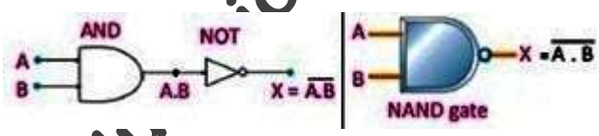
NAND gate is obtained by coupling a NOT gate with the output terminal of the AND gate. The NOT gate inverts the output of the AND gate.

Symbol:

The output of the NAND gate is written as:

$$X = \overline{A.B}$$

It is read as X equals A AND B NOT.



Truth table:

A	B	$X = \overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

27. Define NOR gate. Also write its symbol and truth table.** ***(ALP)

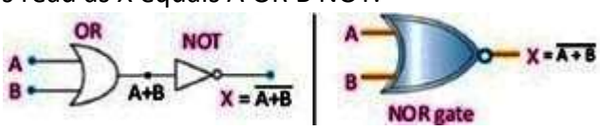
The NOR gate is obtained by coupling the output of the OR gate with the NOT gate. The NOT gate inverts the output of the OR gate.

Symbol:

The output of the NAND gate is written as

$$X = \overline{A + B}$$

It is read as X equals A OR B NOT.



Truth table:

A	B	$X = \overline{A + B}$
0	0	1
0	1	0
1	0	0
1	1	0

28. Write uses of logic gates. OR What is meant by LDR? ***(ALP)***

We can use logic gates in electronic circuits to do useful tasks. These circuits usually use light depending resistors (LDRs) to keep inputs LOW. A LDR can act as

a switch that is closed when illuminated by light and open in the dark.

29. Define bit. *(ALP)*

Digital electronics devices store and process $bits$ electronically. A bit represents data using 1's and 0's.

Eight bits is a byte – the standard grouping in digital electronics.

30. What is meant by digitization? *(ALP)*

Digitization is the process of transforming information into 1's and 0's.

Important Long Questions

(1) Explain the working of different parts of oscilloscope.
(2) What is meant by cathode ray oscilloscope? Explain the deflecting plates and the florescent screen.
(3) What is meant by cathode ray oscilloscope? Explain electron gun.
(4) What is meant by thermionic emission? Explain the deflection of electrons by electric and magnetic field.
(5) Differentiate between analogue electronics and digital electronics. Write down names of five analogue and five digital devices that are commonly used in everyday life.
(6) What do you understand by digital and analogue quantities? Write two examples of each.
(7) What are three universal logic gates? Give their symbols and truth table.
(8) NAND gate is reciprocal of AND gate and NOR gate is reciprocal of OR gate discuss.
(9) How safety alarm work? Explain with diagram.